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# DATA SHEET

# BFG31
## PNP 5 GHz wideband transistor

Product specification
Supersedes data of November 1992
File under Discrete Semiconductors, SC14

1995 Sep 12

Philips Semiconductors

PHILIPS

# PNP 5 GHz wideband transistor BFG31

## FEATURES

- High output voltage capability
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability.

## DESCRIPTION

PNP planar epitaxial transistor mounted in a plastic SOT223 envelope.

It is intended for wideband amplifier applications.

NPN complement is the BFG97.

## PINNING

| PIN | DESCRIPTION |
|---|---|
| 1 | emitter |
| 2 | base |
| 3 | emitter |
| 4 | collector |

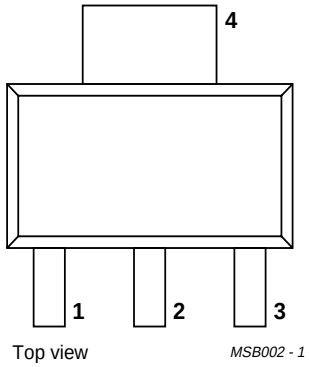



Fig.1 SOT223.

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | open base | – | – | –15 | V |
| $I_C$ | DC collector current | | – | – | –100 | mA |
| $P_{tot}$ | total power dissipation | up to $T_s$ = 135 °C ; note 1 | – | – | 1 | W |
| $h_{FE}$ | DC current gain | $I_C$ = –70 mA; $V_{CE}$ = –10 V; $T_{amb}$ = 25 °C | 25 | – | – | |
| $f_T$ | transition frequency | $I_C$ = –70 mA; $V_{CE}$ = –10 V; f = 500 MHz; $T_{amb}$ = 25 °C | – | 5.0 | – | GHz |
| $G_{UM}$ | maximum unilateral power gain | $I_C$ = –70 mA; $V_{CE}$ = –10 V; f = 800 MHz; $T_{amb}$ = 25 °C | – | 12 | – | dB |
| $V_o$ | output voltage | $I_C$ = –100 mA; $V_{CE}$ = –10 V; $R_L$ = 75 Ω; $T_{amb}$ = 25 °C | – | 600 | – | mV |

## LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | – | –20 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | – | –15 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | –3 | V |
| $I_C$ | DC collector current | | – | –100 | mA |
| $P_{tot}$ | total power dissipation | up to $T_s$ = 135 °C; note 1 | – | 1 | W |
| $T_{stg}$ | storage temperature | | –65 | 150 | °C |
| $T_j$ | junction temperature | | – | 175 | °C |

**Note**

1. $T_s$ is the temperature at the soldering point of the collector tab.

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | THERMAL RESISTANCE |
|---|---|---|---|
| $R_{th\ j\text{-}s}$ | thermal resistance from junction to soldering point | up to $T_s$ = 135 °C; note 1 | 40 K/W |

**Note**

1. $T_s$ is the temperature at the soldering point of the collector tab.

## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | open emitter; $I_C$ = –10 mA | –20 | – | – | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | open base; $I_C$ = –10 mA | –18 | – | – | V |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | open collector; $I_E$ = –0.1 mA | –3 | – | – | V |
| $I_{CBO}$ | collector cut-off current | $I_E$ = 0; $V_{CB}$ = –10 V | – | – | –1 | µA |
| $h_{FE}$ | DC current gain | $I_C$ = –70 mA; $V_{CE}$ = –10 V; $T_{amb}$ = 25 °C | 25 | – | – | |
| $C_{cb}$ | collector-base capacitance | $I_C$ = 0; $V_{CB}$ = –10 V; f = 1 MHz; | – | 1.8 | – | pF |
| $C_{eb}$ | emitter-base capacitance | $I_C$ = 0; $V_{EB}$ = –10 V; f = 1 MHz | – | 5 | – | pF |
| $C_{re}$ | feedback capacitance | $I_C$ = 0; $V_{CE}$ = –10 V; f = 1 MHz; $T_{amb}$ = 25 °C | – | 1.6 | – | pF |
| $f_T$ | transition frequency | $I_C$ = –70 mA; $V_{CE}$ = –10 V; f = 500 MHz; $T_{amb}$ = 25 °C | – | 5 | – | GHz |
| $G_{UM}$ | maximum unilateral power gain; note 1 | $I_C$ = –70 mA; $V_{CE}$ = –10 V; f = 500 MHz; $T_{amb}$ = 25 °C | – | 16 | – | dB |
| | | $I_C$ = –70 mA; $V_{CE}$ = –10 V; f = 800 MHz; $T_{amb}$ = 25 °C | – | 12 | – | dB |
| $V_o$ | output voltage | note 2 | – | 600 | – | mV |
| $V_o$ | output voltage | note 3 | – | 550 | – | mV |

**Notes**

1. $G_{UM}$ is the maximum unilateral power gain, assuming $S_{12}$ is zero and $G_{UM} = 10 \log \frac{|s_{21}|^2}{(1-|s_{11}|^2)(1-|s_{22}|^2)}$ dB.
2. $d_{im}$ = –60 dB; $I_C$ = –70 mA; $V_{CE}$ = –10 V; $R_L$ = 75 Ω; $T_{amb}$ = 25 °C;
   $V_p = V_o$ at $d_{im}$ = –60 dB; $f_p$ = 850.25 MHz;
   $V_q = V_o$ –6 dB; $f_q$ = 858.25 MHz;
   $V_r = V_o$ –6 dB;$f_r$ = 860.25 MHz;
   measured at $f_{(p+q-r)}$ = 848.25 MHz.
3. $d_{im}$ = –60 dB (DIN 45004B); $I_C$ = –70 mA; $V_{CE}$ = –10 V; $R_L$ = 75 Ω; $T_{amb}$ = 25 °C;
   $V_p = V_o$ = at $d_{im}$ = –60 dB; $f_p$ = 445.25 MHz;
   $V_q = V_o$ –6 dB; $f_q$ = 453.25 MHz;
   $V_r = V_o$ –6 dB; $f_r$ = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.

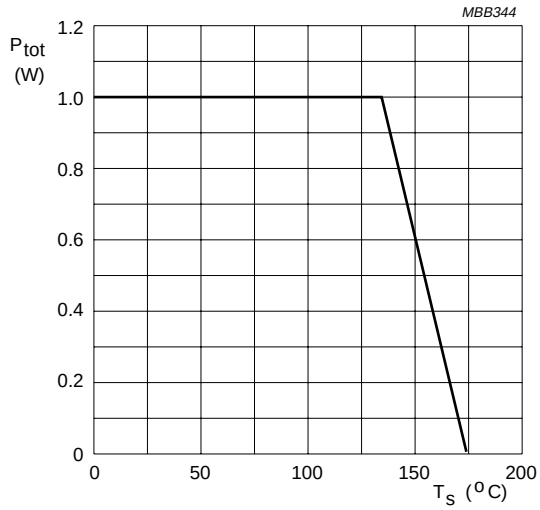
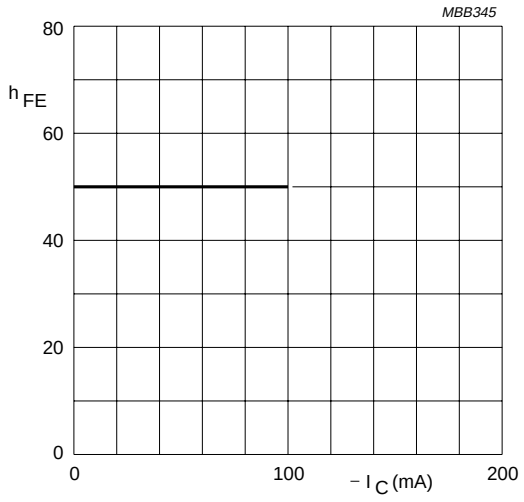
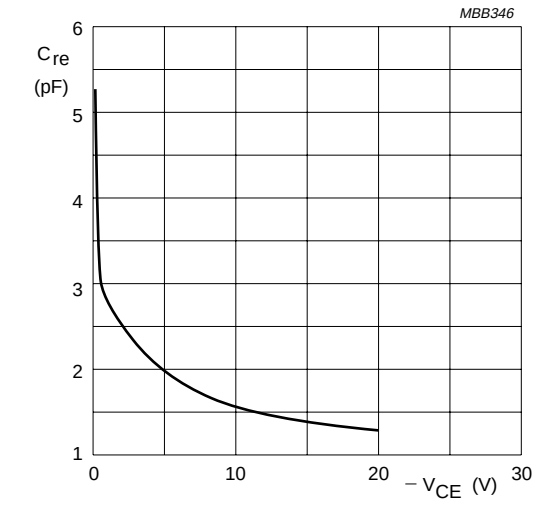



Fig.2 Power derating curve.



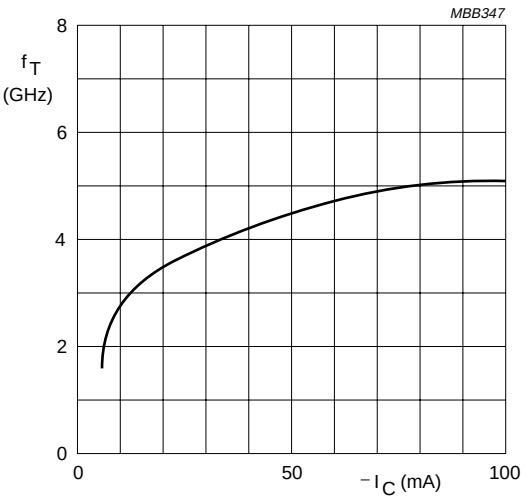

$V_{CE}$ = –10 V; $T_{amb}$ = 25 °C.

Fig.3 DC current gain as a function of collector current.



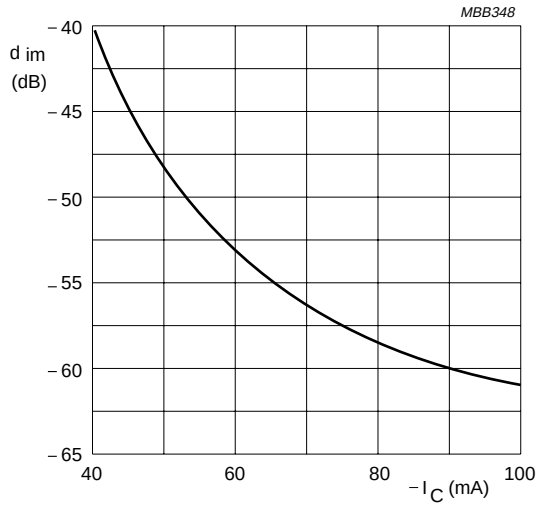

f = 1 MHz; $T_{amb}$ = 25 °C

Fig.4 Feedback capacitance as a function of collector-emitter voltage.



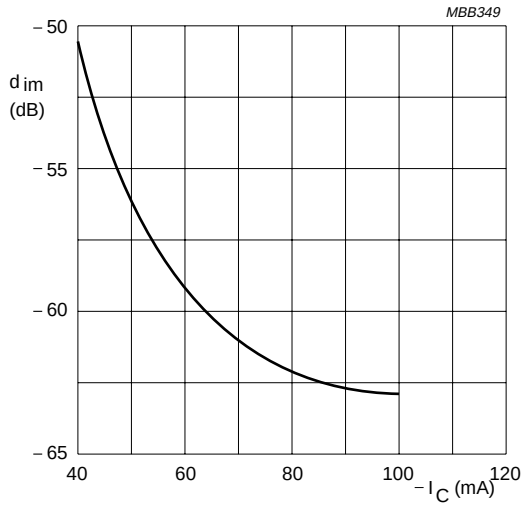

$V_{CE}$ = –10 V; $T_{amb}$ = 25 °C.

Fig.5 Transition frequency as a function of collector current.



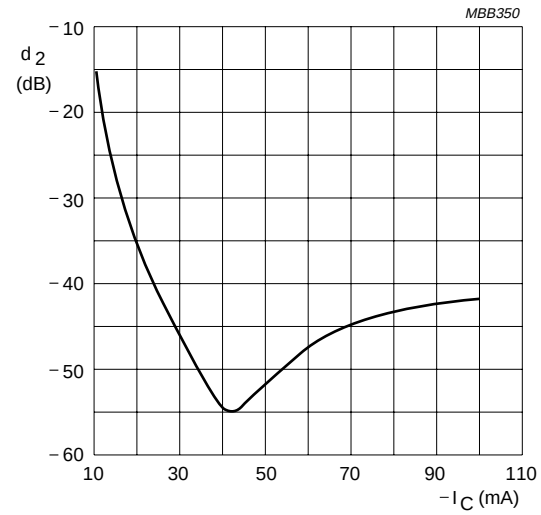

$V_{CE}$ = –10 V; $V_o$ = 650 mV; $T_{amb}$ = 25 °C;
$f_{(p+q-r)}$ = 443.25 MHz.

Fig.6 Intermodulation distortion as a function of collector current.



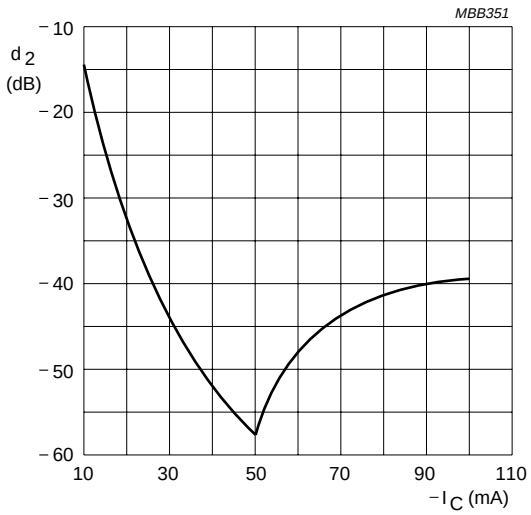

$V_{CE}$ = –10 V; $V_o$ = 550 mV; $T_{amb}$ = 25 °C;
$f_{(p+q-r)}$ = 848.25 MHz.

Fig.7 Intermodulation distortion as a function of collector current.




$V_{CE}$ = –10 V; $V_o$ = 50 dBmV; $T_{amb}$ = 25 °C;
$f_{(p+q)}$ = 450 MHz.

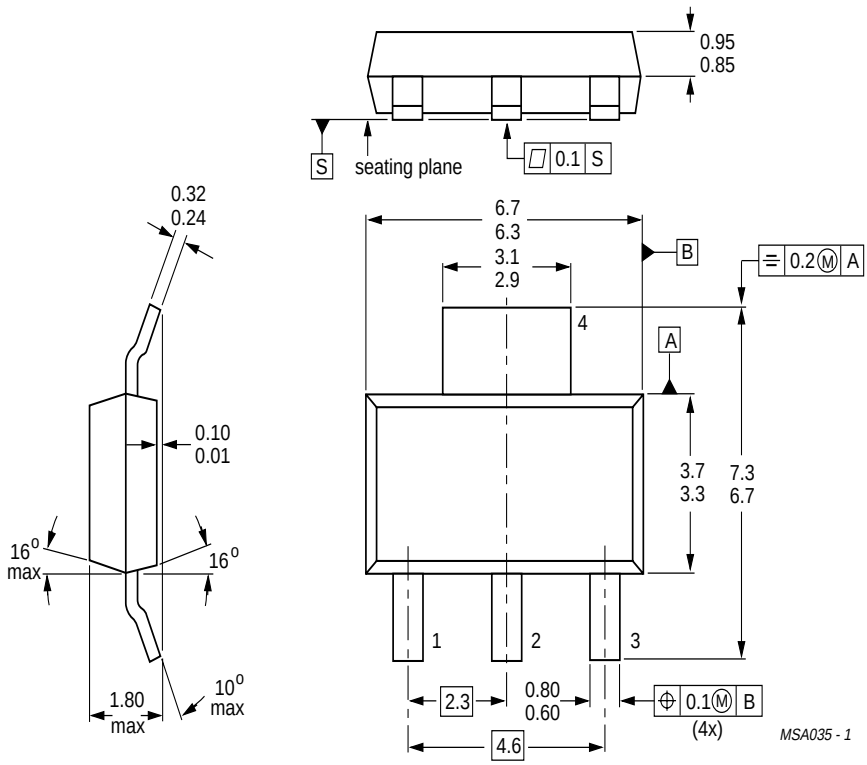
Fig.8 Second order intermodulation distortion as a function of collector current.




$V_{CE}$ = –10 V; $V_o$ = 50 dBmV; $T_{amb}$ = 25 °C;
$f_{(p+q)}$ = 810 MHz.

Fig.9 Second order intermodulation distortion as a function of collector current.

**PACKAGE OUTLINE**




Dimensions in mm.

Fig.10 SOT223.

## DEFINITIONS

| **Data sheet status** | |
|---|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability. | |
| **Application information** | |
| Where application information is given, it is advisory and does not form part of the specification. | |

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